

The NOG sample: selection of the sample and identification of galaxy systems

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Abstract. In order to map the galaxy density field in the local universe, we select the Nearby Optical Galaxy (NOG) sample, which is a volume-limited ($cz \leq 6000$ km/s) and magnitude-limited ($B \leq 14$ mag) sample of 7076 optical galaxies which covers 2/3 (8.29 sr) of the sky ($|b| > 20^\circ$) and has a good completeness in redshift (98%).

In order to trace the galaxy density field on small scales, we identify the NOG galaxy systems by means of both the hierarchical and the percolation *friends of friends* methods.

The NOG provides high resolution in both spatial sampling of the nearby universe and morphological galaxy classification. The NOG is meant to be the first step towards the construction of a statistically well-controlled galaxy sample with homogenized photometric data covering most of the celestial sphere.

1. The selection of the NOG

Relying, in general, on photometric data tabulated in LEDA (Paturel et al. 1997), we select the Nearby Optical Galaxies (NOG) sample, a sample of 7076 galaxies which lie at $|b| > 20^\circ$, have recession velocities (in the Local Group frame) $cz \leq 6000$ km/s, and have corrected total blue magnitudes $B \leq 14$ mag. We have incorporated numerous new redshifts given by the Optical Redshift Survey (Santiago et al. 1995), the Updated Zwicky Catalog (Falco et al. 1999), and the newly completed PSCz survey (for which data have been kindly provided to us by William Saunders).

We select the sample attempting to tighten the selection criteria already used in the ORS survey, specifically, by adopting a complementary approach to the construction of an all-sky optical galaxy sample. Specifically, we use, as photometric selection parameter, the total blue magnitudes, homogeneously transformed into the standard system of the RC3 catalogue and corrected for Galactic extinction, internal extinction and K-dimming. This is meant to minimize systematic selection effects as a function of direction in the sky and, thus, provide a largely unbiased view of the galaxy distribution. We limit the sample to the depth of 6000 km/s in order to reduce the incompleteness in redshift and have a dense sampling of the galaxy density field. From the analysis of the behaviour of galaxy counts versus magnitude, we find that the NOG is intrinsically complete down to its limiting magnitude $B=14$ mag. Moreover, it has a good completeness in redshift ($\sim 98\%$).

Fig. 1 shows the NOG galaxies and the IRAS 1.2 Jy sample (Fisher et al. 1995) limited to 6000 km/s, using Flamsteed projections in Galactic coordinates. The region devoid of galaxies is the zone of avoidance. Similar, prominent structures stand out in these plots such as the densest part of the Local Supercluster at $l = 300^\circ - 315^\circ$, $b = 30^\circ - 75^\circ$ with the Virgo cluster at $l = 284^\circ$, $b = 75^\circ$, the Hydra-Centaurus complex (around $b = 20^\circ$, $l = 260^\circ - 310^\circ$), together with the contiguous Telescopium-Pavo-Indus supercluster (from $b = -20^\circ$, $l = 330^\circ$ to $b = -60^\circ$, $l = 30^\circ$ and the Perseus-Pisces supercluster ($l = 110^\circ - 150^\circ$). There are also pronounced voids such as the Local Void, which covers a large part of the sky between $l = 0^\circ$ and $l = 80^\circ$, the Orion-Taurus void ($l = 150^\circ - 190^\circ$, $b \sim -30^\circ$), and the Eridanus void (around $l = 270^\circ$, $b = -65^\circ$).

2. The Identification of Galaxy Systems

Since we are interested in describing the galaxy density field also on small scales, we identify galaxy systems in the NOG by means of the hierarchical method (according to the precepts given by Gourgoulhon et al. 1992) and percolation *friends of friends* method (with the distance and velocity link parameters chosen as in Ramella et al. 1997).

We obtain two homogeneous catalogs of loose groups which turn out to be substantially consistent. Containing about 500 groups with at least three members, they are among the largest catalogs of groups presently available in the literature. Most of the NOG galaxies ($\sim 60\%$) are found to be members of galaxy pairs (~ 580 for a total of $\sim 15\%$ of the galaxies) or groups with at least three members (~ 500 groups comprising $\sim 45\%$ of the galaxies). About 40% of the galaxies are left ungrouped (field galaxies).

3. Conclusions

The NOG groups will be used to remove non-linearities in the peculiar velocity field on small scales. To correct the redshift-distances of field galaxies and groups on large scales, we shall apply models of the peculiar velocity field, following the approach described in Marinoni et al. (1998). We shall use the locations of individual galaxies and groups calculated in real-distance space to calculate the selection function of the NOG sample (following the approach described in Marinoni et al. 1999) and to reconstruct the galaxy density field (see the paper by Marinoni et al. in the same volume).

Though being limited to a depth of 6000 km/s, the NOG covers interesting regions of galaxy and mass overdensities of the local universe, such as the "Great Attractor" region and the Perseus-Pisces supercluster. Compared to previous all-sky optical and IRAS galaxy samples (e.g. the Optical Redshift Survey by Santiago et al. 1995, the IRAS 1.2 Jy by Fisher et al. 1995, the PSCz by Saunders et al. 1999), the NOG provides a denser sampling of the galaxy density field in the nearby universe. NOG contains 11% more galaxies than the ORS limited to 6000 km/s and 35% more galaxies than the PSCz limited to the same depth, although it covers about 3/4 of the solid angle covered by the PSCz. Besides, NOG delineates overdensity regions with a greater contrast than IRAS samples do (see Fig. 1).

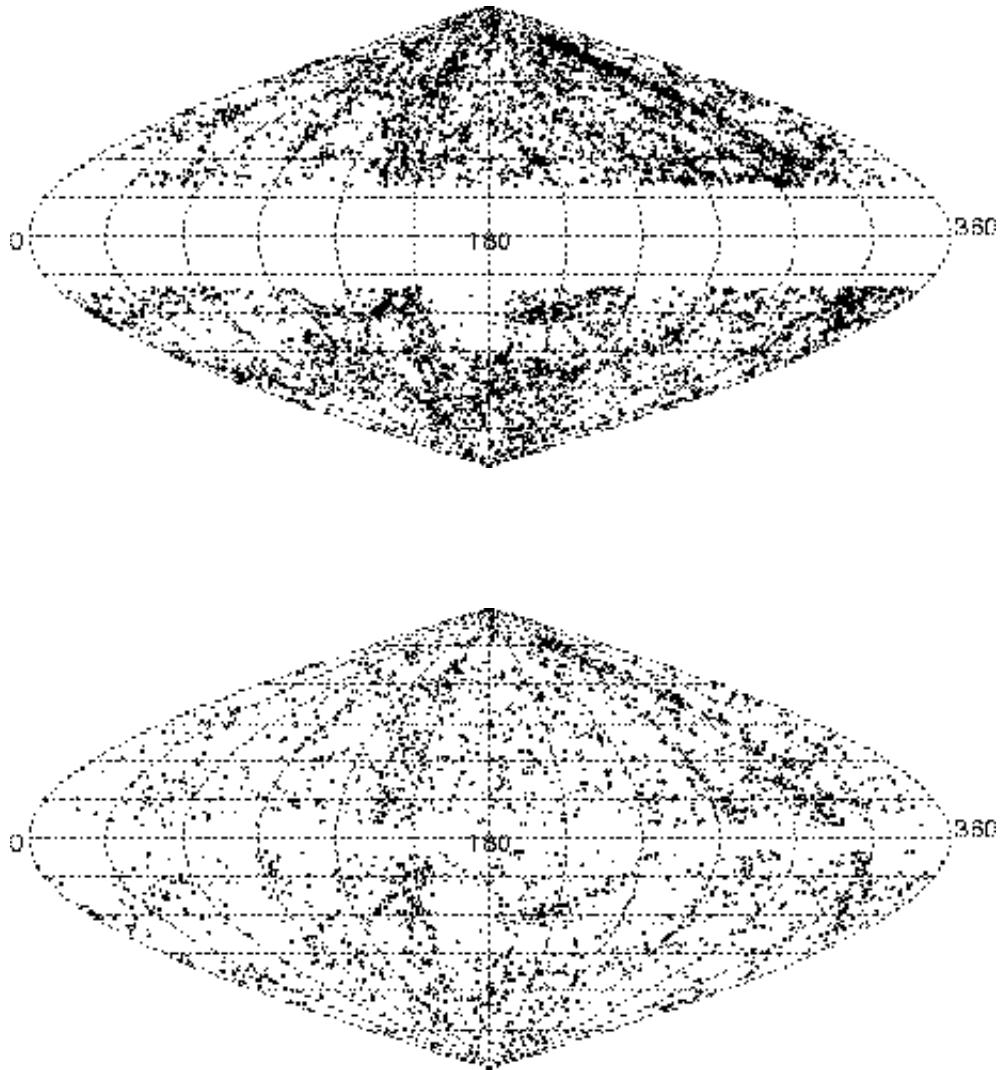


Figure 1. *Upper:* The NOG sample is shown in Flamsteed projection on the celestial sphere using Galactic coordinates. *Lower:* The IRAS 1.2 Jy sample by Fisher et al. 1995 limited to 6000 km s^{-1} is shown in the same projection. In spite of the smoothing caused by projection over distance, prominent structures and voids are still visible.

Given its large sky coverage, its high-density sampling, and the identification of galaxy systems, the NOG is well suited to mapping the cosmography of the nearby universe, studying the clustering properties and tracing the optical galaxy density field (also on small scales) to be compared with the IRAS galaxy density field. Local galaxy density parameters derived from the NOG are meant to be used in statistical investigations of environmental effects on nearby galaxies, along the lines followed by Giuricin et al. (1993) on the basis of the NBG (Tully 1988) sample.

References

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